

What is claimed is:

1. A non-invasive method of recognizing the identity of a human or animal by recognizing non-visible internal tissue having a substantially stable unique distinguishing characteristic comprising the following steps:

5 a) generating an electrical oscillating signal;
b) converting said electrical oscillating signal of step (a) to an acoustic energy beam, said acoustic energy beam having at least one frequency in the range between 100 KHz and 10 MHz;

c) transmitting said acoustic energy beam through an external accessible surface
10 to said non-visible internal tissue;

d) receiving an emitted acoustic energy beam from said non-visible internal tissue, said emitted acoustic energy beam responsive to said transmitted acoustic energy beam;

e) converting said emitted acoustic energy beam to an emitted electrical signal;

15 f) forming a current representative pattern of said non-visible internal tissue having said substantially stable unique distinguishing characteristic in response to said emitted electrical signal, said forming of said current representative pattern comprising:

(i) generating at least one amplitude versus time plot, wherein the amplitude and interpeak distance of an echo peak is in response to said emitted electrical
20 signal;

(ii) determining a minimum threshold amplitude value parallel to an x-axis and normal to a y-axis of said plot, thereby dividing said plot into selecting and eliminating areas;

(iii) calculating at least one ratio of said peaks in the selecting area to provide a
25 representative pattern; and

g) comparing a previously produced and stored master representative pattern of said non-visible internal tissue with said current representative pattern of same.

2. The method of claim 1, wherein said acoustic energy beam comprises at least one frequency which is substantially non-attenuating in internal tissue.

30 3. The method of claim 1, wherein step (b) and step (c) are performed by a transmitting transducer.

4. The method of claim 3, wherein step (d) and step (e) are performed by a receiving transducer.

5. The method of claim 4, wherein said transmitting transducer and said receiving transducer comprise the same transducer.

6. The method of claim 1, wherein said acoustic energy beam comprises at least one frequency from about 1 MHz to about 5 MHz.

7. The method of claim 1, wherein said non-visible internal tissue comprises at least one medium.

8. The method of claim 5, wherein said transmitting through accessible surface comprises positioning said same transducer on said external accessible surface and transmitting said acoustic energy beam substantially normal to said non-visible internal tissue.

9. The method of claim 8, wherein said non-visible internal tissue comprises at least one member selected from the group consisting of skeletal tissue, fat tissue, cartilage, organs, muscle tissue, soft tissue, blood vessels, and nervous system tissue.

10. The method of claim 8, further comprising sweeping said same transducer in a horizontal direction and moving vertically a short distance after each horizontal sweep repeating until a survey of a predetermined portion of said external accessible surface is completed.

11. The method of claim 5, wherein said transmitting through external accessible surface further comprises contacting said same transducer with said external accessible surface and sweeping said transmitting and receiving transducer in at least a ninety degree arc in both the x direction and y direction.

12. The method of claim 1, wherein said non-visible internal tissue comprises skeletal tissue.

13. The method of claim 1, wherein said forming current representative pattern further comprises:

- a) dividing the amplitude versus time plot into a substantially square grid pattern;
- b) subdividing said square grid pattern into a plurality of square subframes;
- c) assigning an integer to each said square subframes;

d) sectioning said amplitude versus time plot into at least one investigating region containing echo peaks of interest, wherein boundaries of said investigating region are parallel to the y-axis of said plot and normal to the x-axis;

- e) measuring distance of said investigating region included within said boundaries having a value quantified by the number of subframes;
- f) determining the center of each said selected echo peak in said investigating region;
- 5 g) measuring interpeak distance, parallel to the x-axis, between said centers of each said selected echo peak having a value quantified by the number of subframes;
- h) assigning a ratio value for each of said interpeak distances wherein said measured value in subframes in said interpeak distance is compared to said measured value in subframes included in said investigating region;
- 10 i) converting said ratio value to a decimal representing said interpeak distance;
- j) calculating the average mean of said interpeak distance of all selected echo peaks;
- k) calculating the standard deviation of said average mean;
- l) measuring a height value for each of said selected echo peaks above the
- 15 minimal threshold value having a value quantified by the number of subframes; and
- m) storing said average mean of said interpeak distances and said height values of said selected echo peaks.

14. The method of claim 13, wherein said master representative pattern is produced utilizing the same method for forming said current representative pattern.

20 15. The method of claim 13, wherein said generating at least one amplitude versus time plot comprises;

converting said emitted electrical signal from analog mode to digital mode; and electronically computing said amplitude versus time plot responding to said digitally

25 converted emitted electrical signal.

16. The method of claim 13, wherein said generating at least one amplitude versus time plot comprises:

providing a visual output for observing an electrical signal caused by rapidly changing voltages or currents.

30 17. The method of claim 1, wherein said master representative pattern is replaced with said current representative pattern after at least one positive verification of said person or animal.

18. The method of claim 1, wherein said generated electrical signal is in a pulse mode.

19. The method of claim 1, wherein said emitted acoustic energy beam is in response to the interaction of the transmitted acoustic energy beam with any discontinuities and inhomogeneities within the non-visible internal tissue.

20. A non-invasive method of verifying the identity of a human or animal comprising using acoustic energy having at least one frequency ranging from about 100 KHz to about 10 MHz for recognizing non-visible internal tissue having a substantially stable unique distinguishing characteristic.

21. A non-invasive method of verifying the identity of a human or animal by recognizing non-visible internal tissue having a substantially stable unique distinguishing characteristic comprising the following steps:

a) producing a master representative pattern of said non-visible internal tissue having said substantially stable unique distinguishing characteristic;

b) storing in at least one memory storage system said master representative pattern of said non-visible internal tissue;

c) generating an electrical oscillating signal;

d) sending signal of step (c) to at least one transmitting transducer wherein said signal is converted to an acoustic energy beam;

e) transmitting said acoustic energy beam from said transmitting transducer through an external accessible surface to said non-visible internal tissue wherein said transmitting acoustic energy beam before being emitted is altered by interaction with discontinuities and inhomogeneities within said non-visible internal tissue;

f) receiving an emitted acoustic energy beam from said non-visible internal tissue with at least one receiving transducer wherein said emitted acoustic energy beam is converted to an emitted electrical signal;

g) forming a current representative pattern of said non-visible internal tissue having said unique distinguishing characteristic in response to said emitted electrical signal, said forming of said current representative pattern comprising:

(i) generating at least one amplitude versus time plot, wherein the amplitude of an echo peak is in response to said emitted electrical signal;

(ii) determining a minimum threshold amplitude value parallel to the x-axis and normal to the y-axis of said plot, thereby dividing said plot into selecting and eliminating areas; and

(iii) eliminating said echo peaks below said minimum threshold amplitude value, leaving only selected echo peaks; and

h) comparing said stored master representative pattern of said non-visible internal tissue with said current representative pattern of same.

22. A system for verifying the identity of a human or animal by recognizing non-visible internal tissue having a substantially stable unique distinguishing characteristic comprising the following steps:

a) a means for generating an electrical oscillating signal;
b) at least one transmitting transducer connected to element (a) for converting said electrical oscillating signal to an acoustic energy beam thereby transmitting said acoustic energy beam through an external accessible surface to said non-visible internal tissue wherein said transmitting acoustic energy beam is altered by interaction with discontinuities and inhomogeneities within said non-visible internal tissue before being emitted;

c) at least one receiving transducer for converting an emitted acoustic energy beam from said non-visible internal tissue to an emitted electrical signal;

d) a means for forming a current representative pattern, wherein said emitted electrical signal received from element (c) is transformed into a current representative pattern of said substantially stable unique distinguishing characteristic, said forming of said current representative pattern comprising:

(i) generating at least one amplitude versus time plot, wherein the amplitude of an echo peak is in response to said emitted electrical signal;

(ii) determining a minimum threshold amplitude value parallel to the x-axis and normal the y-axis of said plot, thereby dividing said plot into selecting and eliminating areas; and

(iii) eliminating said echo peaks below said minimum threshold amplitude value, leaving only selected echo peaks; and

e) a means for comparing connected to element (d), wherein said current representative pattern is compared with a previously produced and stored master representative pattern of same.

23. The system of claim 22, wherein the elements (b) and (c) comprises the same transducer.

24. The system of claim 23, further comprising a means for holding said transducer.

25. The system of claim 23, wherein said same transducer transmits said acoustic energy beam having a frequency from about 1 MHz to about 5 MHz.

26. The system of claim 22, wherein said non-visible internal tissue comprises at least one member selected from the group consisting of skeletal tissue, fat tissue, cartilage, organs, muscle tissue, soft tissue, blood vessels, and nervous system tissue.

27. The system of claim 22, wherein said master representative pattern is produced utilizing the same means for forming said current representative pattern.

28. The system of claim 22, wherein said microprocessor generates said current representative pattern from said emitted electrical signal received from element (c)

comprising the following steps:

a) generating at least one amplitude versus time plot, wherein the amplitude of an echo peak is in response to said emitted electrical signal;

b) dividing the amplitude versus time plot into a square grid pattern;

c) subdividing said square grid pattern into a plurality of square subframes;

d) assigning an integer to each said subframes;

e) sectioning said amplitude versus time plot into at least one investigating region containing echo peaks of interest, wherein boundaries of investigating region are parallel to the y-axis of said plot and normal to the x-axis;

f) measuring distance of said investigating region included within said boundaries having a value quantified by the amount of subframes;

g) determining a minimum threshold amplitude value parallel to the x-axis of said plot thereby dividing said plot into selecting and eliminating areas;

h) eliminating said echo peaks below said minimum threshold amplitude value leaving only selected echo peaks in said investigating range;

i) determining center of each said selected echo peak in said investigating region;

j) measuring interpeak distance, parallel to the x-axis, between said centers of each said selected echo peaks having a value quantified by the amount of subframes;

k) assigning a ratio value for each of said interpeak distance wherein said measured value in subframes in said interpeak distance is compared to said measured value in subframes included in said investigating region;

l) converting said ratio value to a decimal representing said interpeak distance;

5 m) calculating the average mean of said interpeak distance of all selected echo peaks;

n) calculating the standard deviation of said average mean;

o) measuring a height value for each of said selected amplitude peak above the minimal threshold value having a value quantified by the amount of subframes; and

10 p) storing said average mean of said interpeak distance and said height value of said selected amplitude peak.

29. The system of claim 24, wherein said same transducer is positioned on said the external accessible surface whereby said transmitting acoustic energy beam is transmitted substantially normal to said non-visible internal tissue.

15 30. The method of claim 1, wherein said acoustic energy of said acoustic energy beam has a frequency of between about 100 KHz and about 10 MHz.

31. The method of claim 1, wherein said acoustic energy of said acoustic energy beam has a pulse width of between about 1 and about 10 microseconds.

20 32. The method of claim 1, wherein said electrical oscillating signal has an amplitude of between about 10 millivolts and about 500 Volts.

33. The method of claim 1, wherein said generated acoustic energy comprises a transmission mode selected from the group consisting of pulse-echo, pitch-catch, and through.

25 34. The method of claim 1, wherein said acoustic energy of said acoustic energy beam comprises ultrasonic waves.

35. The method of claim 34, wherein said ultrasonic waves include longitudinal waves.

36. The method of claim 3, wherein said transmitting transducer comprises a low value of Q.

30 37. The method of claim 3, wherein said transmitting transducer is loaded on a non-radiating surface within a material comprising a high absorption characteristic.

38. The method of claim 3, wherein said acoustic energy beam is capable of being focused.

39. The method of claim 3, wherein said transmitting transducer features a scanning capability by means of mechanical motion.

5 40. The method of claim 39, wherein said mechanical motion comprises at least one motion selected from the group consisting of linear and rotary motion.

41. The method of claim 3, wherein said transmitting transducer has a nominal frequency in a range of about 1 to about 5 MHz.

10 42. The method of claim 1, further comprising a means for amplifying said electrical oscillating signal.

43. The system of claim 22, further comprising a means for impedance matching between said transmitting transducer and said electrical oscillating signal means.

44. The system of claim 22, further comprising a coupling medium between said transmitting transducer and said external accessible surface.

15 45. The method of claim 13, wherein said amplitude versus time plot comprises an "A-scan".

46. The method of claim 42, wherein said means for amplifying comprises a time-variable gain amplifier.

47. The method of claim 46, further comprising a time-variable filter circuit.

20 48. The method of claim 1, wherein said acoustic energy of said acoustic energy beam comprises multiple frequencies.

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